DIMENSIONS NBS

The magazine of the National Bureau of Standards U.S. Department of Commerce

September 1977

DEVELOPMENTS FOR THE SHIVA. See page 22.

COMMENT

PARTNERS FOR PROGRESS

An exciting limited partnership involving the National Bureau of Standards and the Office of Product Standards (OPS) exists to strengthen the voluntary standards system and to apply standards technology to the solution of important problems affecting domestic and international trade.

OPS is a small, policy-making constituent unit of the Commerce Department's Office of the Assistant Secretary for Science and Technology. Its principal responsibility is to enhance the ability of the Department to help solve national policy issues concerning many aspects of industrial or consumer affairs, particularly product standards, on both national and international scales.

Currently, OPS is responsible for the overall management of two programs which directly affect the private sector: the National Voluntary Laboratory Accreditation Program and the Consumer Product Information Labeling Program. In each case, technical support is provided by NBS' Institute for Applied Technology.

The objectives and procedures of product labeling are aptly described in Fred McGehan's article in this issue of DIMENSIONS/NBS. The laboratory accreditation program is designed to judge the capability of test laboratories to evaluate products against existing standards. Upon demonstrating that they meet or surpass previously established criteria, the laboratories will be accredited by the Department of Commerce as having the ability to perform tests satisfactorily in accordance with appropriate standards. The criteria are established by a committee whose membership is composed of a reasonable balance of various categories of interested parties.

Expected in the reasonably near future is a new assignment to the Department of major importance to industry and government at all levels: administration of a long-awaited Office of Management and Budget (OMB) Circular on the interaction of the federal government and the private sector in the area of product standards. This would give important new powers and responsibilities to the Secretary of Commerce.

For example, the proposal includes a requirement that private standards-writing organizations follow prescribed procedures if they want the federal government to become involved in or to support certain of their activities—procedures such as due process and provisions for appeals. If a standards-writing organization declined to comply, the federal government could refuse to use the organization's standards or even prohibit government personnel from sitting on its standards-writing committees. If events go as expected, OPS will be delegated the responsibility for overall management of this program, with NBS carrying out several different technical support roles.

The basis for this proposed OMB Circular was established by the Interagency Committee on Standards Policy (ICSP), which is chartered by the Secretary of Commerce. The ICSP developed a set of policy principles and then asked the Secretary to refer them to OMB for promulgation. The chairman of the ICSP is the Deputy Assistant Secretary of Commerce for Product Standards (who also functions as Director of OPS). The secretariat for the ICSP is provided by NBS' Office of International Standards.

The NBS-OPS partnership is a good one. It is an effective, cohesive working relationship that is making good progress in strengthening the voluntary product standards system and putting it to good use in the service of some of the nation's most important causes.

Howard I. Forman

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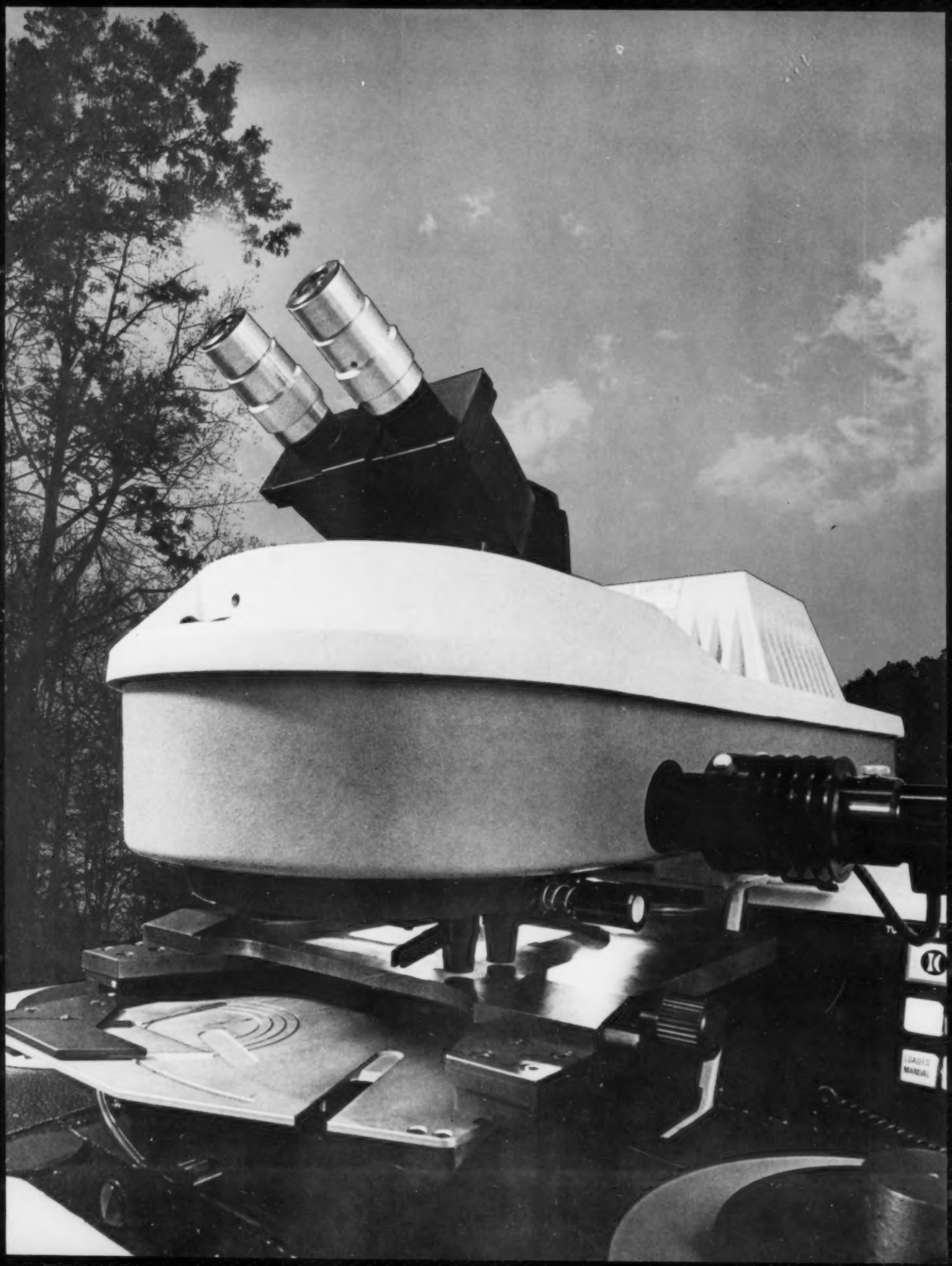

ULTRAVIOLET RADIATION:

PROBLEMS AND ISSUES

by Ernest Ambler

The following is adapted from a speech delivered on June 8, 1977, at the NBS Symposium on Radiation Measurements for Environmental Protection and Public Safety.

WE live today in a situation where exposure to ultraviolet radiation—both natural and artificial—is on the upswing. It is increasingly evident that we need to examine quantitatively the impact of this condition on our environment, our economy, and our own health and safety.

To do so with any degree of meaning will require communication—exchange of ideas and techniques across the traditional disciplines. It will require the interest of such groups as the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Department of Agriculture, the Council for Optical Radiation Measurements, and the National Bureau of Standards.

As we begin this symposium, it seems appropriate to briefly survey the issues, to identify the key landmarks, and to establish some perspective wherein we hope to operate. Note three facts:

- Each year 300,000 persons develop skin cancer and approximately 6,000 die from the disease. A major contributing factor is UV radiation in natural sunlight;
- More than one-half billion dollars is spent annually on industrial processes which involve UV radiation and which must be quantitatively understood and monitored; and
- An increasing amount of medical treatment and therapy is dependent on UV radiation which must be carefully measured in order to provide reproducibly dosed exposures.

As I consider these facts, I am struck by several similarities between these and a number of other issues we face at NBS. Increasingly, we are dealing with matters of broad public concern: issues which contain a critical technological component; issues which imply an unknown risk factor for the public; issues which are truly national, and even international, in scope. The results of our collective research must include consideration of economic and political limitations, environmental impact, and even human behavior patterns, aesthetics, and equity.

Whether we are scientists or research managers, this puts us into a somewhat unfamiliar situation. We must cope with the traditional gamut of management problems associated with our respective organizations. We must also bring our technical backgrounds into the planning process. But most important, we must increase our awareness of the prevailing public climate. It is by this measure that

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Dr. Ambler is acting director of the National Bureau of Standards.

our political and industrial leaders allocate resources.

Former Secretary of Commerce Elliott Richardson often cited the need to develop information which is used by policymakers and is perceived to be being used honestly. In part, Mr. Richardson said, ". . . there is no more basic contribution to the possession of intelligent choice than the compilation and dissemination of reliable facts. . .standards. . .measurements. These are the things that enable us to deal in common terms with a highly complex technological age."

Thus, as we consider the issue of UV radiation, we must accept as our first given the responsibility for the development and application of credible scientific data. We must strive to meet three goals:

- To identify the controlling or critical technical factors;
- To evalulate the appropriateness of the scientific and technological premises relative to the need or application; and
- To explore the complete range of possible conclusions and the resulting probable impacts.

By providing reliable technical facts, we can assist the nation's policymakers in the selection of wise courses of action. But how can we compile these reliable facts? By what criteria do we assure credibility and reliability?

Traditionally, the techniques used by science for establishing reliable facts have been quite specific. These techniques have included controlled experimentation, an accepted body of theory, concurrence by the scientific community, and carefully defined limitations of the subject of study. By these techniques, we have developed a coherent and invaluable structure which we call "scientific knowledge."

But as I mentioned, many of the problems we face today—like that of UV radiation measurements—are different in character. They are of great public concern, and solutions are urgently sought. Often the problem involves concepts outside our experience in traditional science. Increased measurement accuracy or even new measurement techniques may be required. The measurable quantities may be defined in unfamiliar terms. Furthermore, the permissible range of controlled experimentation may yield results that must be extrapolated to the areas of relevance.

Obviously, there is no clear-cut, simple answer to the production of credible data. In considering the problem, we must ask whether the technical questions can be pursued objectively—apart from the economic, political, and human factors. Can such a separation be maintained without the loss of necessary relevance and realism? As representatives of the technical community, we must strive to develop a framework within which individual technical contributions can be assembled and assessed.

Beyond my philosophic rhetoric, there lies a concrete framework waiting to be identified. As recently as 1966, the ultraviolet portion of the spectrum was of little importance to the public as compared with the visible portion. Recently, however, three separate and specific issues have turned our attention to the ultraviolet and have, in fact, generated a need for more accurate UV radiation measurements.

First, you will recall I mentioned the incidence of skin cancer. The biological effects of solar UV radiation are related mainly to wavelengths in the UV-B region of 280-320 nm (sometimes referred to as erythemal radiation). Since ozone is the primary atmospheric gas that filters out much of the shortwave UV radiation from the sun, any decrease—whether it be man-made or natural—in the ozone concentration in the stratosphere is expected to increase the amount of UV-B reaching the earth's surface and thereby potentially increase the incidence of such biologic effects as skin cancer.

But biological effects are not the only ones resulting from changing solar radiation levels. Small changes in the total solar spectral irradiance in the UV below 400 nm on the earth's atmosphere could significantly change the global heat balance. Correspondingly, this could have wide-ranging implications for solar energy utilization and global food production.

Two important recent measurements of the above-atmosphere spectral irradiance in the UV below 400 nm differ by as much as 15 percent. The accuracy needed in this spectral region is at least 2 percent for any meaningful analysis of the variation and effects of UV radiation on the earth's surface, and the measurements must be conducted over the entire 11-year solar cycle. Not only are new radiation standards and calibration techniques needed for obtaining reliable data on this question, but improved types of absolute radiometers need to be developed.

Both of these areas involve what I call "natural" or solar radiation. But there are two more areas of concern, and they have to do with "artificial" radiation from man-made sources. I mentioned that we are spending more than one-half billion dollars on industrial processes involving UV radiation. I should

also tell you that this figure is increasing at a rate of about 30 percent a year.

What are these processes and how many people work in these fields? One of the most common applications is in accelerated weathering machines used to simulate degradation or to cure such substances as paints, plastics, dyes, and building materials. UV radiation is also used to expose photoresists in the microelectronics industry and dry ink imprinted on canned beverages. More than half a million persons are involved in these and other industrial processes using UV radiation.

Certainly it is the responsibility of industry to operate these various facilities with all necessary consideration for the safety of the workers. However, there are regulatory aspects of this matter. The responsibilities are shared by the Bureau of Radiological Health, the National Institute of Occupational Safety and Health, the Occupational Safety and Health Administration, and the Environmental Protection Agency. Since prevention of hazardous exposure is the solution being sought by these agencies, routine measurements of potential UV hazards will probably be a key element in each agency's program. It seems clear that a new level of reliability and efficiency will be required of these measurements.

As with solar radiation, biological effects are not the only ones which we must recognize and evaluate. To minimize production costs in industrial processing, one needs to optimize rates of curing or the completion of a reaction induced by radiation, while at the same time minimizing radiation damage and heating effects. The same improvements in measurement technology that will protect the public from UV hazards will also promote increased productivity in these industrial applications.

The present level of accuracy obtained in the best field measurements appears to be plus or minus 16 percent. This is not acceptable for many intended purposes. What is needed are both improved levels of accuracy and new levels of convenience and versatility in making reliable field measurements of UV radiation.

The final area of concern is the use of UV radiation in medical therapy and medical research. Carefully measured and reproducibly dosed exposure to UV radiation is being used more and more in the treatment and therapy of certain diseases. In addition, UV radiation is being used to cure new enamel in corrective dentistry.

However, not enough is known about the spectral irradiance from the lamps being used, and even

One application of UV radiation: curing new enamel in corrective dentistry.

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less is known about possible adverse side effects of the exposure. Without accurate characterization of the irradiation used in therapy, it is impossible to pinpoint the wavelength range, or "action spectrum," providing the most effective therapeutic action. In the absence of reference standards, the regulator can only surmise the maximum exposure rate, and he may be overconservative in order to assure the safety of the patient. Thus, the net result from the treatment may be zero: no damage to patient and, similarly, no benefit.

Improved spectral irradiance measurement techniques and standards need to be developed to establish an accurate baseline for the judicious use of UV radiation in medical therapy.

I have outlined a problem where we must address three issues:

- the levels of UV radiation hitting the earth;
- the levels of UV radiation being used in industrial processes; and
- the levels of UV radiation being used in medical therapy and research. To my mind, the bottom line in these issues is better measurement. The critical need today is the measurement base.

The uncertainty associated with the measurement of incoherent optical radiation such as from UV lamps is presently too large. The current state of the art uncertainty in the laboratory measurement of UV irradiation from lamps ranges from about plus or minus 2 percent at 350 nm to about plus or minus 10 percent at 200 nm. These are the best measurements we have been able to make at NBS. Currently measurements made in the field will have uncertainties greater than the 2 to 10 percent achievable at NBS.

There are a number of things we are trying to do to improve this situation. In addition to trying to improve the blackbody temperature-based approach to making spectral measurement, NBS is pioneering the development of another method based on an electrically calibrated detector. This is an important new concept of considerable potential and is made possible only by the most recent technology.

There are a number of other projects presently underway at NBS for the purpose of reducing the uncertainties of practical measurements. For example, one is the development of specialized standards such as the deuterium lamp for spectral irradiance measurements between 200 nm and 350 nm. The irradiance of the 30-watt deuterium lamp is considerably greater than that of the 1000-watt tungsten quartz halogen lamp below 260 nm and is significantly less above 350 nm. The influence of other parts of the spectrum on the measurement of UV radiation is thus an insignificant problem in the case of the deuterium lamp.

Unfortunately, these lamps aren't as stable as tungsten lamps, so uncertainty of the standard is larger—about 6 percent. Nevertheless, they should be of significant benefit in facilitating spectral irradiance measurements below 300 nm, including those used in erythemal research.

Let me note that the current NBS program in UV measurements and standards is comprehensive, covering the region from 4 nm to 400 nm, using a variety of standard sources and detectors. Our activities consist of:

- providing necessary basic national standards;
- characterizing these standards and transfer standards;
- developing required new measurement techniques; and
- consulting with the manufacturers of transfer instrumentation so that it can be calibrated effectively.

As we look to find where NBS will fit into the framework of the future, I anticipate that NBS programs will be accelerated and expanded through greater coordination with other organizations. Furthermore, I expect that our emphasis will be on developing and characterizing improved detectors and sources and on developing improved national standards, a systematized dissemination mechanism to transfer the measurement technology to the users, and better interactions with these users.

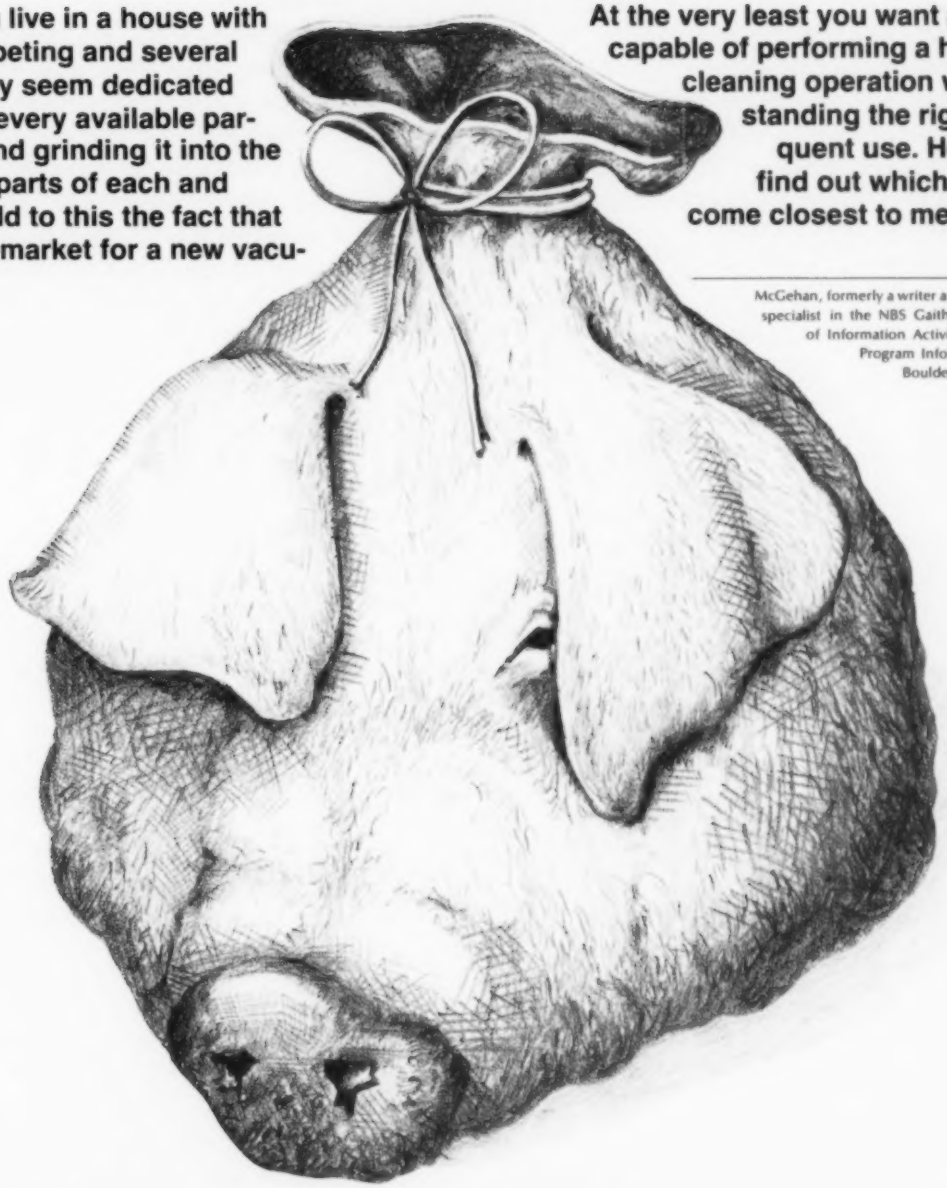
At this symposium on Ultraviolet Radiation Measurement for Environmental Protection and Public Safety, I hope we can begin to shape the future to meet our goals. □

by Frederick P. McGehan

LET THE BUYER BE AWARE!

Let's say you live in a house with plenty of carpeting and several children. They seem dedicated to attracting every available particle of dirt and grinding it into the most visible parts of each and every rug. Add to this the fact that you're in the market for a new vacuum cleaner.

At the very least you want a machine capable of performing a heavy duty cleaning operation while withstanding the rigors of frequent use. How do you find out which machines come closest to meeting your needs?



McGehan, formerly a writer and public information specialist in the NBS Gaithersburg, Md., Office of Information Activities, is now with the Program Information Office at the Boulder, Colo., laboratories.

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TODAY, if you want to compare how different brands of consumer products perform, don't go where the products are sold. Except for labels that rate certain home appliances by the amount of energy they use, information on product performance at the point of sale either is scarce or is presented in ways that make comparison shopping difficult.

The situation may be different in the future, however. If a pilot program being conducted by the federal government proves successful, products might soon carry labels that show performance characteristics—like durability—in ways that make comparison easy.

The pilot project, called the Voluntary Consumer Product Information Labeling Program, was begun recently by the Department of Commerce's Office of Product Standards. The National Bureau of Standards will provide technical support.

Five Administrations, including the present one, have expressed a desire to help consumers obtain better product performance information. A 1973 report by the National Business Council for Consumer Affairs recommended: "Wherever appropriate, manufacturers should promote the development of mechanisms for providing consumers with performance information on consumer durables."

Consumers rate getting a fair deal while shopping above such issues as reforming the federal bureaucracy, restoring integrity to government, and creating a national energy policy.

The Department announced its intention to develop a voluntary consumer product labeling program in the Federal Register on May 25, 1976. A series of three public hearings—in Los Angeles, Chicago, and Washington, D.C.—followed within a month. Consumers, retailers, manufacturers, trade associations, testing laboratories, and others commented on the proposal.

A total of 97 responses showed two-thirds favoring the initiation of a labeling program and one-third—primarily large appliance manufacturers—recommending against it.

"Because of consumer support, the decision was made to go forward—but the program will have to prove itself," notes Howard I. Forman, director of Commerce's Office of Product Standards. "At the end of the year (which began June 24, 1977), a decision will be made as to whether we're justified in continuing the program," Forman says. "During this period we hope that at least one and possibly three products will be selected and labeled."

The program works this way:

Anyone interested in the labeling of a particular kind of consumer product is urged to write the Secretary of Commerce, U.S. Department of Commerce, Washington, D.C. 20230 and make the request. Requests might come from consumers who had difficulty in obtaining information about certain products. They might come from manufacturers who could realize an advantage from product labeling. Or they might come from trade associations representing many manufacturers of the same product.

The request can simply name a kind of product, but Forman says, "We hope people will say more than that—tell us why they need the information and what kind of information it is they want."

Next, the Secretary of Commerce will select products for labeling. Comments from consumers, manufacturers, and other interest groups will be solicited during this time. The selections will be published in the Federal Register.

Forman's office will depend on the Center for Consumer Product Technology at NBS to recommend which performance characteristics should be listed on a label. "The Bureau will come up with probably no more than 8 performance characteristics for a given product," Forman states. Initially at least, the performance characteristics will be based on test methods that already exist and are agreed on by the industry. (Given the one-year life of the pilot phase of the program, it would take too long to develop test methods from scratch.)

The performance characteristics that are selected and the test procedures to be used in measuring these characteristics will be published in the Federal Register for comment. After this procedure, participating manufacturers will evaluate their products, using the agreed on test methods, and

label their products for the specified performance characteristics. For example, a specific characteristic may be rated on a scale of one to 10, with one being poor and 10 being excellent. Examples of performance characteristics might include noise levels, strength—and energy efficiency for products not already covered under other federal labeling programs.

"If the manufacturers follow all of the requirements set out in the procedures, they will be

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Above. Howard I. Forman.
"If the manufacturers follow all of the requirements . . . they will be authorized to use a logo which will be developed by the Department of Commerce."

Right. Stanley I. Warshaw.
"One of the severest penalties a manufacturer can face is to have the privilege of using the label revoked."

authorized to use a logo which will be developed by the Department of Commerce," Forman notes. The use of this logo means the manufacturer has followed the labeling specifications for that product established by the Department's program.

A manufacturer who volunteers to label his products under the program is committed to presenting exactly the kinds of information that have been agreed on for that product. No data on performance characteristics can be added or subtracted from the label. "They've either got to show all the previously agreed on information or none," Forman states.

"When consumers know and understand performance characteristics of the products they buy, it strengthens the competitive system."

ESTHER PETERSON

The pilot program was unveiled at a June 30 press conference at which Esther Peterson, special assistant to the President for consumer affairs, offered the strong support of her office. Peterson said the program would allow products to compete on the basis of quality. "The polls today show that people are willing to pay more money if they are assured of better quality. If I know what that increased price is for, what it is going to mean to me, I may be willing to pay it. When consumers know and understand the performance characteristics of the products they buy, it strengthens the competitive system because manufacturers compete on the basis of the facts regarding their products."

Jordan J. Baruch, Commerce's Assistant Secretary for Science and Technology, says, "We are not interested in ranking things as good or poor. It is our task to specify a set of measures so the consumer can say 'for me this is good' or 'for me that other one is better.'" The Assistant Secretary also points out that it is not the Department's task to "say whether a product is safe or unsafe. Many other agencies do that."

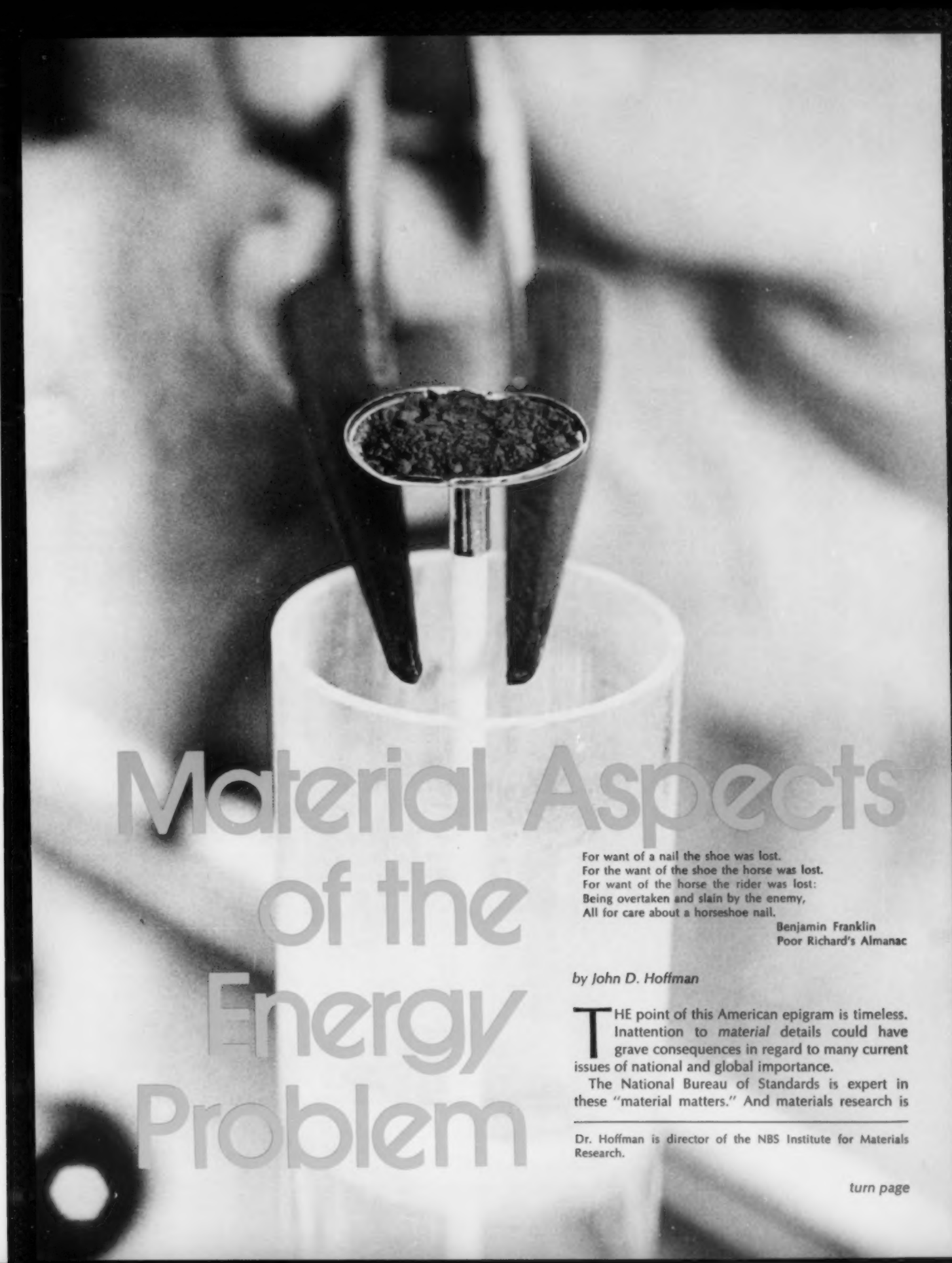
Questions have been raised concerning the validity of the information on the label. Will NBS test the products to assure that they conform with the ratings determined by the manufacturer? "No," says Assistant Secretary Baruch, "NBS will not routinely test products. But it will specify test methods, and the manufacturers will have to agree to use those test methods in order to have the Department's logo on their labels."

If a manufacturer falsifies data, Baruch notes, it most likely will be brought to the Department's attention by a competitor or by a consumer, and then the Bureau could be asked to run a test. If the data were found in error, the manufacturer would face having his privilege to use the label revoked. Cheaters could also be prosecuted for false advertising by an enforcement agency like the Federal Trade Commission.

Stanley I. Warshaw, director of NBS' Center for Consumer Product Technology and a participant at the press conference, claims that "One of the severest penalties a manufacturer can face is to have the privilege of using that label revoked. The right to use the label would be removed immediately if cheating were proved. Many, if not all, of his competitors would have the label and he would be at a severe disadvantage. That can often be a more severe penalty than some punishments for committing a crime."

As the labeling program gets underway, there are encouraging signs from the private sector that the goals for it coincide with rising consumer expectations. A recent poll conducted for Sentry Insurance Company by the Harvard Marketing Science Institute and Louis Harris pollsters found that consumers rate getting a "fair deal" while shopping above such issues as reforming the federal bureaucracy, restoring integrity to government, creating a national energy policy, and controlling air and water pollution. Some 83 percent of those polled were concerned about misleading packaging or labeling, 81 percent were concerned about the absence of reliable information about different products and services, and 59 percent complained about the difficulty of choosing among so many products.

"There is no question that the need for a labeling program exists. It will now be up to the Commerce Department program to show that such a need can be satisfied," Forman notes. □



Material Aspects of the Energy Problem

For want of a nail the shoe was lost.
For the want of the shoe the horse was lost.
For want of the horse the rider was lost:
Being overtaken and slain by the enemy,
All for care about a horseshoe nail.

Benjamin Franklin
Poor Richard's Almanac

by John D. Hoffman

THE point of this American epigram is timeless. Inattention to *material* details could have grave consequences in regard to many current issues of national and global importance.

The National Bureau of Standards is expert in these "material matters." And materials research is

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Dr. Hoffman is director of the NBS Institute for Materials Research.

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often crucial in solving technical problems associated with energy policies, plans, and development. Such is the case with coal gasification and other emerging technologies for energy generation.

Many parts of a coal gasification system operate at temperatures and pressures substantially higher than present industrial processes. Traditional materials cannot withstand the corrosive and erosive nature of the particle-laden gases.

The pressure vessels used in these systems are lined with ceramic. We at the National Bureau of Standards have been investigating the mechanical strength of candidate ceramic liners after they have been exposed to the pressures and temperatures anticipated in service. Based on our knowledge of these ceramics at lower temperatures and pressures, we expected that one particular class would have good strength and hold up well at these elevated conditions. (This type, incidentally, was the most expensive ceramic of the group.) Instead, the strength of the ceramic dropped during use to very low values. At the high temperatures and pressures involved, a new substance formed, causing this dramatic loss. However, we found that another class of ceramic materials did not exhibit this behavior, and it appears to be suitable as a lining.

The need for reliable measurements on materials at the elevated temperatures and pressures typical of coal gasifiers is a major impetus for materials research over the next few years. Without such basic data, it will not be possible to construct and verify theories for predicting the performance of materials over their service lifetimes.

A second example of an emerging energy generation technology is magnetohydrodynamics (MHD), where a combustion process leads directly to electrical energy. Calculations indicate that present efficiencies in electrical generation of about 40 percent could be increased to between 50 and 60 percent by MHD developments. But here, too, limitations in materials performance are roadblocks to progress.

The combustion chamber, channel, electrodes, insulating materials, and related parts of an MHD system must be able to withstand thermal shock and resist corrosion through oxidation, erosion, and alkali attack. Questions concerning the selection and behavior of materials in this environment are largely unanswered, due in part to a shortage of reliable physical and chemical data and also to the lack of engineering experience with the materials under MHD conditions. One NBS program is designed to evaluate the materials used in MHD and to provide design and process engineers and technologists with data on properties and performance.

If we consider geothermal energy and certain aspects of nuclear power, we see that these technologies will also require improvements in materials performance and increases in our basic knowledge of corrosion prevention. Geothermal plants are high-volume, once-through power systems, so there is little opportunity to treat the waters chemically to minimize corrosion. Stress corrosion cracking of stainless steel piping in reactor systems has led to reactor downtime.

In addition to the major emerging technologies is another method for generating energy: the combustion of fuel derived from municipal solid wastes. Recent studies have shown that the economical operation of municipal resource recovery systems depends on the recovery of the energy in the organic fraction of the waste. Such refuse-derived fuel presents several challenging materials problems. The heat content of the refuse varies, depending on the materials mix. Plastics, at present, form a significant fraction of the fuel, and their burning may liberate extremely corrosive gases which damage incinerators and equipment. These gases are very much different from those encountered in the combustion of coal, fuel oil, and natural gases.

We have started a program at NBS to characterize the properties of refuse-derived fuel. We know already that our corrosion specialists and chemists will be drawn into this investigation as more questions are raised about the suitability of this type of fuel in present steam-generating units.

Our program on recycling illustrates quite well another major materials/energy interface: energy savings by reuse of recovered materials. A prime example of such savings is the recovery and reuse of aluminum scrap: Remelting aluminum scrap requires only 5 percent of the energy needed to produce new aluminum. Other substances which can be recovered include steel, copper, and glass.

NBS, in response to the Resource Conservation and Recovery Act of 1976, is developing guidelines for the specification of these materials so that they can be marketed easily after recovery. The control of the quality through such specifications is quite important. For example, the presence of traces of iron in copper wire made from recycled copper increases its electrical resistance markedly, and thus would increase electrical energy loss in copper transmission lines.

Briefly, another major energy-saving trend which will require major materials research and engineering efforts is the substitution of lighter weight ma-

terials such as aluminum and plastics for heavier components in moving parts and transportation systems. All of us are aware of these substitutions in automobiles—and of the resulting gasoline savings.

In the future we can also expect more efficient use of energy in industrial processes. This will occur, in part, by better and closer management of consumption: more use of insulation, closer temperature control, and the like. However, many industries are beginning to consider "fine tuning" of the processes themselves to increase efficiency.

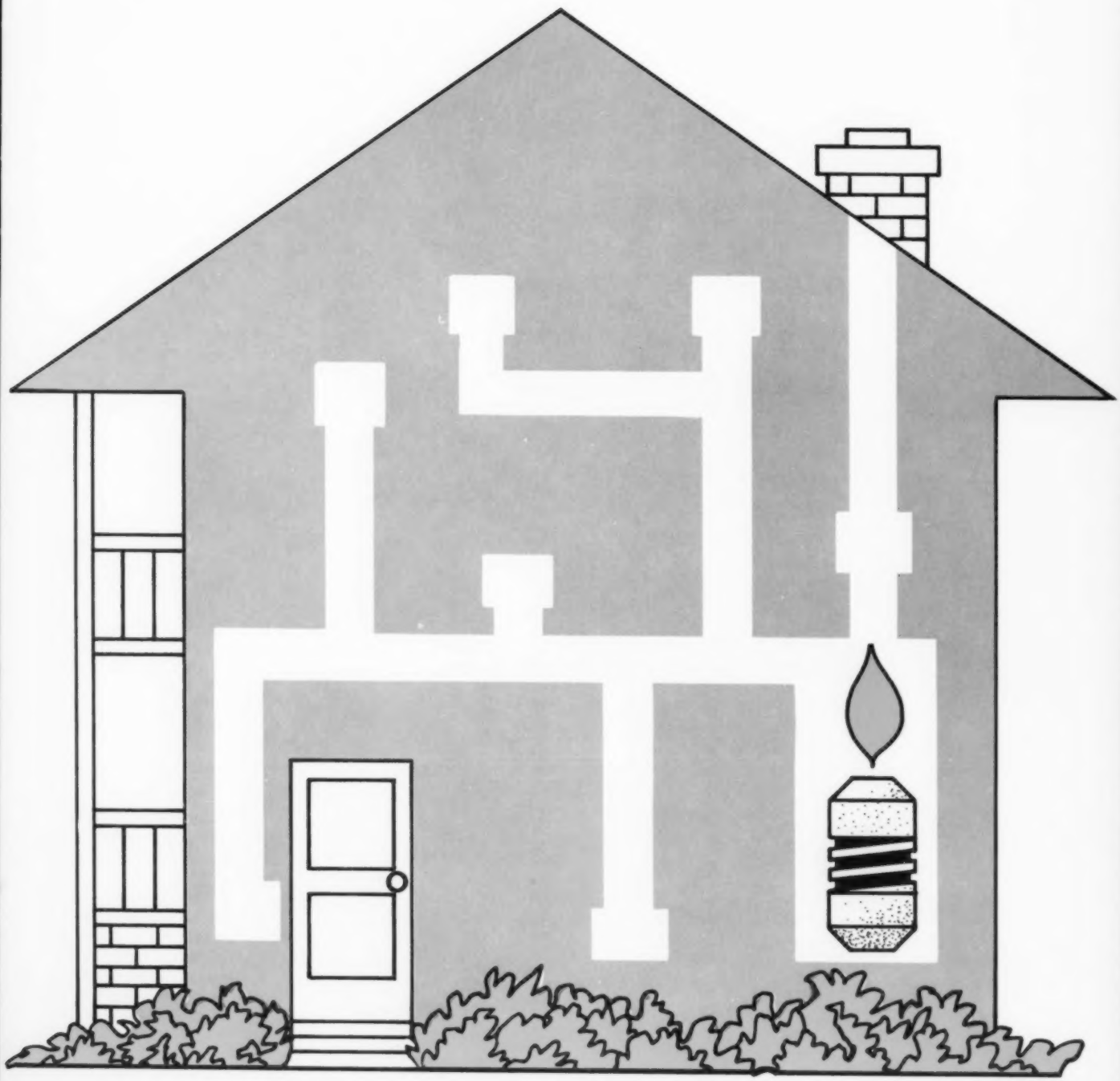
NBS has been asked by industry to supply more accurate, evaluated data and predictive schemes for the basic thermodynamic data on industrially important compounds. This seems to be the beginning of a trend to optimize processes to minimize waste. Presently, NBS is measuring the thermodynamic properties of ethylene, one of the most important industrial feedstocks. Our other experimental, thermodynamic measurements of compounds will undoubtedly emphasize major industrial chemicals.

Obviously, solutions to major energy problems require research and advances in materials science. NBS, with its focus on measurement, standards, and data, is deeply involved in these materials/energy interfaces. □

NBS chemist Taki Negas tests a candidate electrode material for MHD systems. The device is a differential thermal gravimetric analyzer for measuring heat effects, phase transition, and other key properties.

Technician Chris Johnson holds fractured stainless steel specimens from a test related to coal gasification.

DON'T LET YOUR FURNACE



GUZZZLE OIL

IMPROVING the efficiency of the 14½ million oil-fired furnaces in the United States can save homeowners money on their fuel bills this winter, according to the National Bureau of Standards' Center for Building Technology (CBT). Annual maintenance checkups will keep a furnace operating at top efficiency and will reduce pollution. In addition, fuel costs can be further reduced by having a service technician adjust the firing rate of the burner or by having him replace the burner.

The energy savings possible by an adjustment in firing rate were shown in a field study in New England conducted by the Walden Research Division of Abcor for CBT under the sponsorship of the Federal Energy Administration (FEA). The study showed that 97 percent of the burners tested were overfired, many by 100 to 200 percent. Overfiring means that the furnace burns oil at a faster rate than is necessary to maintain a comfortable house temperature even on the coldest day. This means the furnace runs only a small fraction of the total time, which is inefficient.

In the field study, firing rates were reduced on 25 representative heating systems, including air, hot water, and steam systems, by installing smaller nozzles and adjusting the excess air to obtain the highest carbon dioxide level in the flue gas possible without smoking. These tests indicated that substantial energy savings in fuel consumption—as much as 8 percent—could result from reduced burner firing rates in oversized systems if the carbon dioxide level in the flue gas were unchanged or increased after the reduction. An even greater savings—up to 30 percent—is possible by replacing inefficient burners with new high efficiency devices that have reduced firing rates.

NBS and FEA have prepared a booklet for oil distributors with guidelines for optimizing nozzle size on high pressure burners. This booklet, "A Service Manager's Guide to Saving Energy in Residential Oil Burners," is available by writing the Center for Building Technology, National Bureau of Standards, Washington, D.C. 20234.

In addition, NBS, FEA, and the Environmental Protection Agency have prepared a consumer brochure, "How to Improve the Efficiency of Your Oil-Fired Furnace." The following is reprinted from the brochure. Single copies are available free of charge from the Consumer Information Center, Pueblo, Colorado 81009.

Is it really possible for me to save money by improving the efficiency of my heating system?

Yes. Recent field tests revealed that almost all of the oil burners examined were oversized. Consult your service technician for advice on the most appropriate modifications and potential fuel savings for your system.

How much money can I expect to save by improving the efficiency of my system?

The cost of most modifications suggested in this pamphlet will be paid for in fuel savings over relatively short periods of time. The following table shows the dollar savings per $100 of annual fuel cost that can be achieved by increasing the efficiency of your furnace. Remember, as fuel prices increase, your payback period is shortened.

Dollar Savings Per $100 of Annual Fuel Cost

From Original Efficiency Of	To An Increased Efficiency Of					
	55%	60%	65%	70%	75%	80%
50%	$9.10	$16.70	$23.10	$28.60	$33.00	$37.50
55%		8.30	15.40	21.50	26.70	31.20
60%			7.70	14.30	20.00	25.00
65%				7.10	13.30	18.80
70%					6.70	12.50
75%						6.30

How can I find out what modifications are applicable to my heating system?

Read through this pamphlet to get a general understanding of how your heating system works, the things you can do yourself, the efficiency tests that a service technician can perform, and the efficiency you can expect from an oil burner heating system. This will enable you to do some things yourself. It will also give you enough information to talk knowledgeably to a qualified service technician and make decisions on his recommendations.

turn page

Isn't my heating system a complex piece of equipment?

Yes, but its basic operation is quite simple. Your heating system consists of four principal parts: the burner, the furnace or boiler, the heat distribution system, and the chimney.

The burner generates heat by burning fuel oil. Part of the heat produced by the burning of the fuel is absorbed by the furnace or boiler and transferred to air or water, which is then distributed throughout the home by air ducts or hot water pipes and radiators. The heat that is not absorbed by the furnace or boiler is lost up the chimney in the process of disposing of smoke and gases. The overall heating system efficiency depends on the performance of each of these parts.

How can I find out if my burner is working efficiently?

Call your local oil burner service technician. Have him measure the carbon dioxide level in your flue. This measurement gives you an indication of the combustion efficiency of the system. Oil must be thoroughly mixed with air to burn completely. This usually requires more air than is actually needed to convert the carbon and hydrogen in the fuel to carbon dioxide and water, which are the products of complete combustion. The amount of this excess air can be determined by measuring the amount of carbon dioxide in the flue.

Generally, the higher the carbon dioxide level, the less excess air used and the more efficient the combustion process. Too little air however, causes smoking, increases pollution, and reduces efficiency. A carbon dioxide level of 9 percent is considered good. Levels over 11 percent are excellent. If, after tune up and adjustment, your service technician cannot obtain a carbon dioxide reading of at least 9 percent, without smoking, it may be that:

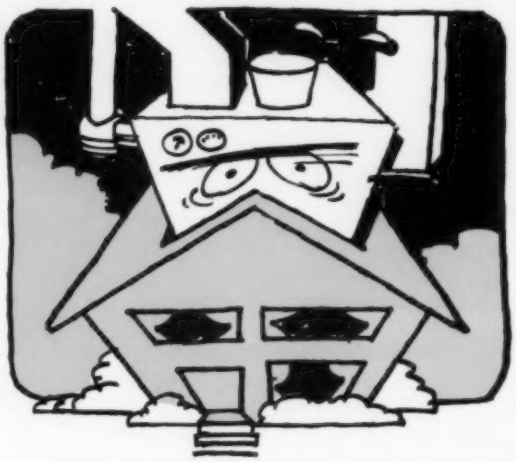
- The furnace is leaking air into the combustion chamber and needs to be properly sealed;
- There is too little or too much draft up the chimney; or
- The air and oil are not thoroughly mixing for combustion.

Correcting these problems requires modification or replacement of the burner. If your service technician is unable to get an efficiency of 65 percent or better through tune-up and nozzle size adjustment, it may pay to buy a new burner. A new burner should get at least 75 percent efficiency. You can figure the cost savings using the table. Even greater savings can often be achieved by installing a burner with a smaller firing rate if the existing heating system is oversized.

Have your service technician identify the problem and explain how it can be fixed and what the net savings to you will be.

Is it possible that my heating system is oversized?

Recent field tests have shown that furnaces and boilers are usually oversized for the heating requirement of the house. Even on the coldest day of the year many heating systems run less than 30 percent of the time. During these long off-periods, heat is lost up the chimney, greatly reducing the overall efficiency.



How can I find out if my system is oversized?

Your service technician can determine if your system is oversized. He does this through a series of measurements and calculations that take into account the average daily temperatures in your region, the amount of oil used, and alternative nozzle sizes.

He may recommend that you have a smaller nozzle installed. With a smaller nozzle size, your system will run longer but burn less oil per unit of time, and the amount of heat lost up the chimney will be reduced.

How can the efficiency of my furnace or boiler be improved?

Have your service technician measure the temperature of the flue gas leaving the furnace or boiler. Flue gas temperatures should be between 205 to 316 °C (400 to 600 °F) for an original furnace and 316 to 371 °C (600 to 700 °F) for conversion burners. Excessive temperature, measured after the burner nozzle has been properly adjusted, indicates that:

- The burner nozzle size is too large and more heat is being generated than can be utilized in the heat exchanger; or
- The heat-exchanger surfaces are badly sooted. Have them brushed and vacuumed. Ask your service technician if your furnace has a fuel oil line solenoid valve. These electrically operated valves close off all the fuel supply as soon as the fire has stopped. This prevents oil from dripping into the combustion chamber causing heavy smoke and soot deposits on the heat exchanger. If you don't have one, it may pay to have one installed.

How can I improve efficiency of heat distribution?

You can do several things to assure that the heat produced by the furnace or boiler efficiently reaches the areas of the home in which it is needed.

If you have a warm air furnace:

- See if you can feel air leaking out of duct joints when the fan is running. If so, seal the joints with ductwork tape. If ducts run through unheated spaces, wrap them with insulation. Vertical chases in walls, through which supply and return ducts pass, should be sealed off to prevent heat from being lost. Check to see that the chimney is sealed from the house structure both at the basement level and the attic. It should be sealed with non-combustible material to protect the combustible material of the house structure from the hot chimney.

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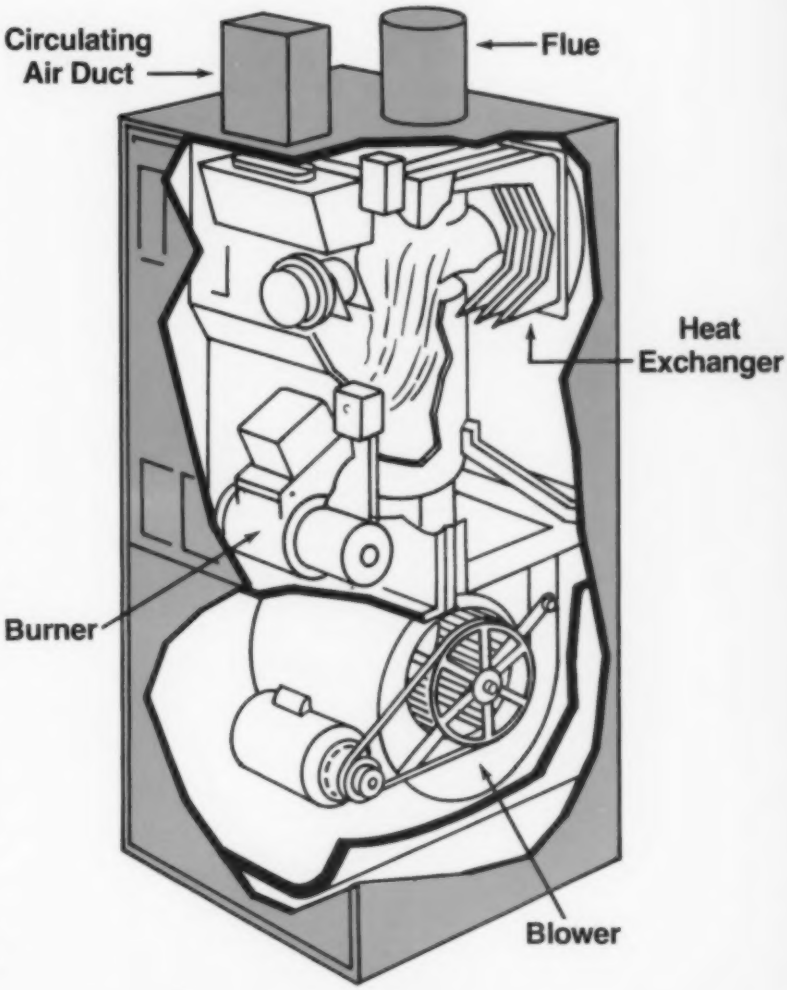
- Clean or change air filters frequently during the heating season. Clothes dryers and home workshops create dust and lint. In houses where these are located near the oil burner, the filters will need to be changed more frequently.



• Have your service technician check and reset, if necessary, the on and off temperature settings of the furnace fan. To conserve fuel, the fan should shut off when the furnace temperature is about 32 °C (90 °F). It should not go on again until the burner comes on and raises the furnace temperature to about 43 °C (110 °F).

If you have a hot water boiler:

• Insulate the boiler, the hot water storage tank, and hot water piping in unheated spaces.

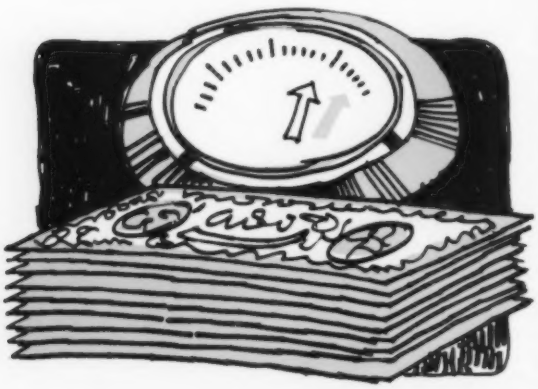
• Clean radiators or baseboards to make certain they are not blocking air circulation.

How can the performance of my chimney be improved?

Most chimneys or vents produce more draft than is necessary. It is the job of the draft control to prevent this. Ask your service technician to measure the draft at the flue collar of your furnace and over the fire and adjust the draft control if necessary. If you do not have a barometric draft damper, consider installing one to improve the seasonal efficiency of your system.

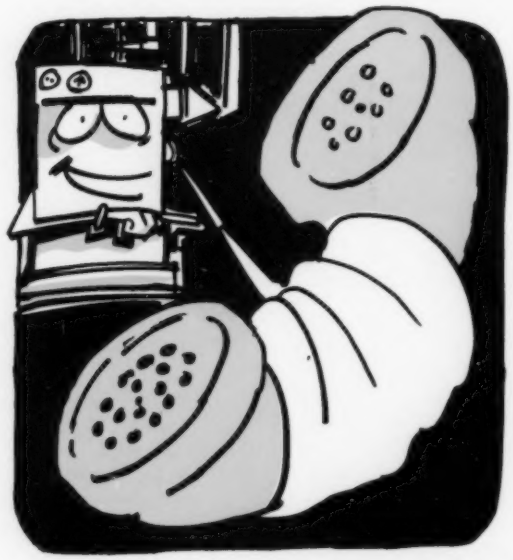
Does lowering my thermostat setting at night really save money?

Tests have shown that a 2.5-degree Celsius (5-degree Fahrenheit) reduction in setting for approximately 8 hours will save up to 10 percent in fuel costs. Greater reductions will lower fuel costs even more. Consider installing a clock thermostat that will automatically set the thermostat down at night and raise it before you get up in the morning.



Call your service technician today!

Tell him that you would like to have him tune up your furnace and clean it if necessary. He will be glad to discuss these money and fuel saving opportunities with you, show you how he takes burner and flue measurements, and explain the results. Call now—*EVERY DAY'S DELAY MAY BE COSTING YOU MONEY!* □



Improved Efficiency Also Reduces Pollution

In a recent study, the U.S. Environmental Protection Agency found burner tuning plus replacement of nontunable units reduced emission of pollutants on the average by the following amounts:

carbon monoxide	81%
hydrocarbons	90%
particulates	24%
smoke	59%

Further information can be obtained by ordering "Get the Most From Your Heating Oil Dollar," at no cost, from the Office of Public Affairs (MD 31), U.S. Environmental Protection Agency, Research Triangle Park, N.C. 27711.

Note: Most of the data in this pamphlet is based on a field study conducted by the Walden Research Division of Abcor for the National Bureau of Standards under the sponsorship of the Department of Energy.

PARTICIPANTS WANTED FOR IC LINEWIDTH CALIBRATION STUDY

by Michael Baum

The National Bureau of Standards is seeking industrial firms to help evaluate an urgently needed and newly developed physical standard with a set of test procedures for assuring accurate measurements of linewidth on integrated-circuit (IC) photomasks.

The program is aimed at manufacturers of photomasks, integrated-circuits, and linewidth measurement equipment. The test results will enable each participating organization to determine its relative measurement capability and the degree of improvement it can expect from the use of the test procedures and calibrated standard.

Photomasks are used in the printing of integrated-circuits much like film negatives are used in the printing of photographs. Linewidth measurements in the 1- to 10-micrometer range on these masks are now generally made with optical microscopes. For the same line, measurement differences of 0.25 micrometer and larger are commonly observed because of systematic differences—different microscopes, measurement eye-pieces, observers, and operating conditions.

In the current NBS program, supported in part by the Defense Advanced Research Projects Agency, researchers have found that these measurement differences are primarily due to a "measurement offset" associated with each system. Preliminary tests show that the calibrated linewidth standard and measurement procedures can be used to determine and correct these "offsets."

The NBS linewidth standard is etched chromium on glass. Preliminary tests indicate that the calibrations will be accurate to within 0.1 micrometer or better.

Manufacturers interested in participating in the test program will be asked to assign to the project two trained operators who make high-precision linewidth measurements in the 1 to 10 micrometer range as part of their routine inspection of photomasks or as part of the manufacture and inspection of measurement systems. Each of the operators must be available to make measurements one day a week for two weeks.

Manufacturers must also provide an optical microscope with a filar or image-shearing eye-piece, a photometric microscope, or a TV-microscope measurement system. The microscope must operate in bright-field transmitted light and be equipped with a filter for green light (560 nanometers), an objective with numerical aperture of 0.6 or larger, and a condenser with numerical aperture about two-thirds of the numerical aperture of the objective.

Each participant will be furnished with the measurement procedures and a calibrated standard so that the measurements can be made at the participant's facilities. Following the test, each participant will be given his results and the anonymous overall results. Although the participating organization will be able to estimate its errors from these results, the test will not provide a certified calibration.

The present test is limited to 10 separate organizations. Interested firms should describe their equipment in writing and signify that they will assign the appropriate personnel to the test. Send this information to: John M. Jerke, Room A123 Metrology Building, National Bureau of Standards, Washington, D.C. 20234.

Baum is a writer and public information specialist in the NBS Office of Information Activities.

COORDINATION OF FEDERAL SCREW THREAD STANDARDS SHIFTS TO GSA

The publication of screw thread standards for the federal government, formerly the responsibility of the National Bureau of Standards and the Interdepartmental Screw Thread Committee, has been transferred to the General Services Administration (GSA).

The standards, which had been published as NBS Handbook 28, *Screw-Thread Standards for Federal Services,* will now be promulgated as Federal Standard 28 by GSA, which has the responsibility to develop federal standards for procurement purposes. GSA has delegated the responsibility for preparing the standards to the headquarters of the Defense Logistics Agency, and the work will be done by the Defense Industrial Supply Center in Philadelphia, Pennsylvania.

The transfer of responsibility marks the end of the Interdepartmental Screw Thread Committee (ISTC), which has issued the standards for use by the Commerce and Defense departments since 1939. Chaired by the NBS representative, the committee gradually acquired representatives from the Department of Defense, the General Services Administration, the Energy Research and Development Administration, the National Aeronautics and Space Administration, and the Federal Aviation Administration.

Advisors from the American National Standards Institute and various trade and technical societies also aided the committee in the initiation of thousands of high-quality screw thread standards that were recognized and adopted by industrial standards groups in the United States and other countries.

The most visible of the several contributions from the Bureau's participation on the committee came in November of 1948 when representatives from the United Kingdom, Canada, and the United States met at NBS to sign a comprehensive agreement on the unification of screw threads. Because the inch screw thread was so widespread, this served to *de facto,* create the first truly international standards for fasteners.

Technical questions concerning Federal Standard 28 on screw threads should be addressed to Mr. John McGlone, Directorate of Engineering and Standardization, Defense Logistics Agency (DISC), 700 Robbins Ave., Philadelphia, PA 19111, telephone (215) 697-4349.

Questions regarding the administration of the program should be addressed to Mr. Grant Beattie, Standards Control and Support Division, General Services Administration (Federal Supply Service), attn: FMHS, Washington, D.C. 20406, telephone (703) 557-0506.

Although NBS Handbook 28 will not be reissued, a limited number of copies are still available. It consists of three parts. Part I contains information on Unified and Unified miniature screw threads. Part II contains information on pipe threads, including dryseal pipe threads; gas cylinder valve threads; hose coupling, including fire-hose coupling threads; and hose connections for welding and cutting equipment. Part III contains information on Acme, Stub-Acme, Buttress, and miscellaneous threads.

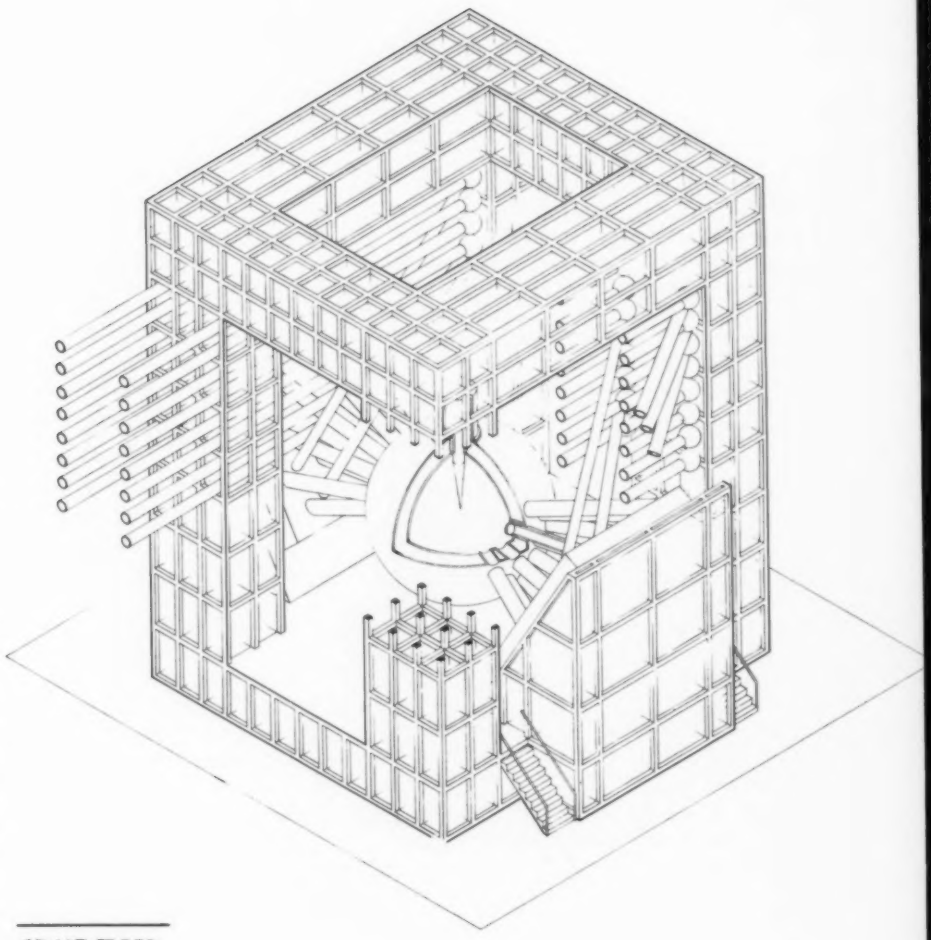
Parts of the handbook are sold individually by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Current stock numbers and prices are: Part I: 003-003-00112-1, $3.80; Part II: 003-003-00109-1, $2.00; Part III: 003-003-00110-4, $1.30. *MB*

STAFF REPORTS

GLASS DEVELOPMENTS FOR SHIVA LASER

Fluorophosphate glasses of very low refractive index and low optical dispersion are being prepared for application in advanced optical systems. An immediate application of these new glasses is for laser rods and lenses used in the giant SHIVA laser at the Lawrence Livermore Laboratory. By increasing beam break-up threshold levels, new glasses are expected to raise usable target energy at the deuterium-tritium thermonuclear fusion pellets by approximately 50 percent.

Wolfgang Haller, Inorganic Materials Division, B326 Materials Building, 301/921-2819.



COVER STORY:

The SHIVA of the Hindu religion is a multi-armed god who is both the destroyer and the creator. The SHIVA glass laser system at Lawrence Livermore Laboratory comprises 10 pairs of high energy laser beams, which are directed at a deuterium-tritium fuel target. The ultimate goal is the generation of usable power in a controlled thermonuclear fusion reaction. Shown here is a model of the target chamber of the SHIVA system.

One of the more sophisticated but less publicized ways being considered for the production of nuclear energy is controlled thermonuclear fusion of deuterium-tritium fuel. In order to initiate thermonuclear fusion, this fuel has to be heated to an effective ignition temperature of about 10^8 °C. Worldwide efforts to achieve controlled ignition involve two schemes. One is magnetic confinement of a plasma in Tokamaks and mirror-and-theta-pinch machines. The second scheme is laser induced fusion, i.e. inertial confinement in which heating of the fuel accompanies isentropic compressions to an extremely high density for approximately one nanosecond.

In the United States both magnetic and inertial confinement are pursued, with the Lawrence Livermore Laboratory (LLL) in California under ERDA-sponsorship being one of the major centers of the latter effort. At LLL, heating of the thermonuclear fuel is achieved by the simultaneous interaction of numerous pulsed laser beams with the fuel target. The largest system under construction is the SHIVA system, which uses 20 simultaneously fired laser chains. The SHIVA system is of such magnitude and complexity that it requires significant advances in laser-engineering, optics, and electronic technologies.

Light beams of high energy density do not obey the classical laws of optics: refractive indices in the laser disks and lenses become energy-density dependent or "non-linear," resulting in beam break-ups, focus-shifts, and hence, partial loss of energy. Thus the amount of laser power

reaching the fuel target is limited by these effects.

ERDA requested NBS to help in the development of optical materials with lower non-linearity (i.e. where the departure from classical laws is less extensive). The program, carried out by the Inorganic Glass Section, consists of two parts: the preparation of new glass compositions, and the development of measurement technology which can be applied to these and other glasses with the appropriate properties, including those which may be developed by the commercial companies eventually fabricating the laser components.

Fluorophosphate and berylium fluoride-based glasses are promising candidates for low non-linear optical components. Such glasses, however, are difficult to prepare because of fluoride volatilization and devitrification problems. Berylium-containing glasses also pose problems of potential toxicity. Fluorophosphate glasses so far prepared by NBS have non-linear indices of 0.5 x 10^{-13} electrostatic units. Compared with the best commercial glasses presently available, this value constitutes a 50 percent improvement in the figure of merit for laser rods and disks.

In comparison to the more conventional silicate- and lead oxide-based glasses, fluorophosphate glasses have low chemical resistance to water and, possibly, to moist air. Nevertheless, they appear to be far superior in moisture resistance to halide crystals which are frequently used in complex optical systems. As the SHIVA laser will be housed in a totally climatized building which is held at low humidity, the fluorophosphate glasses should not pose any insolvable durability problems.

Presently, NBS is devising methods to assess the chemical durability of such glasses. This work is one phase of an effort to develop measurement techniques characterizing optical materials for the SHIVA laser. Measurements will be performed not only on NBS-developed glasses, but also on other candidate glasses (e.g., BeF_2-based glasses) developed by other laboratories participating in the materials program for the SHIVA laser system.

Figures of merit for laser glasses

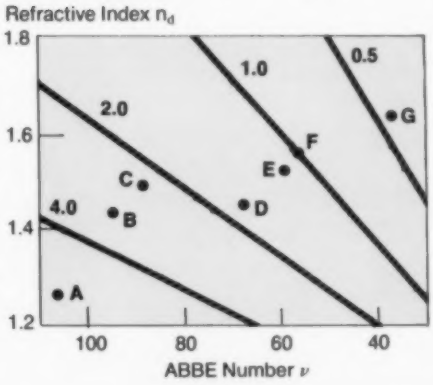


Figure 1—Refractive Indices and Optical Dispersion of Optical Materials. *The Abbe number increases as the dispersion decreases. Figures next to diagonal lines in graph give figures of merit for focus-stability during laser pulse. The letters refer to the following optical materials.*
A—Beryllium fluoride (estimated)
B—NBS fluorophosphate glass
C—Best commercial fluorophosphate glass
D—Vitreous silica
E—NBS SRM 710 (Soda-lime-silica glass)
F—Typical commercial laser glass
G—NBS SRM 711 (lead-silica glass)

WORLDWIDE TIMEKEEPING BETTER THAN PREVIOUSLY BELIEVED

A portable rubidium clock developed by NBS has been used to make time comparisons with laboratories here and abroad. This improved system of time-comparison indicates that time signals worldwide are in closer agreement than previously believed.

Helmut W. Hellwig, Time and Frequency Division, Room 1-2037, Boulder, Colo., 303/499-1000, ext. 3277.

National and international precision time comparisons are done today routinely with Loran C (a low-frequency navigation signal broadcast) and also with portable atomic clocks. The clocks offer significantly better measurement precision, but their use has been limited due to the substantial costs of transporting the heavy, bulky equipment.

A recent clock-carry comparison, made possible by NBS improvements in portable atomic clocks, has indicated that the time-scale-generating clocks in various institutions internationally coordinated by the International Time Bureau (BIH) are in closer agreement than had been previously understood from Loran-C comparisons alone. This result will lead to improved confidence in time which is based on a form of average obtained from these time-scale-generating clocks.

The NBS-developed, small, portable rubidium clock permits time comparisons with other laboratories at much lower cost than was possible in the past with the much bigger cesium clocks. The rubidium clock travels as hand baggage of one person under the seat in an airliner; the cesium clock requires two persons as carriers, an additional extra seat for itself, plus a powered electrical outlet.

The time-comparison precision demonstrated with the NBS rubidium clock in complete round trips is 20 to 50 nanoseconds for comparisons within the U.S. and

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NBS-developed portable rubidium clock just before a trip in a small airplane. The clock can be carried by one person as hand luggage and is powered by internal batteries for 20 hours operation.

Conventional commercial cesium atomic clock occupying its own seat in an airliner. Its battery supply (bottom half of the equipment) will maintain operation for only a few hours; therefore, the clock needs to be plugged into a power outlet during flight.

about 100 nanoseconds between the U.S. and Europe.

Because of the much lower transport costs, a schedule of relatively frequent comparisons with two of the main counterparts of NBS, Boulder, Colorado, have been executed during the past year: nearly monthly comparisons with the U.S. Naval Observatory (USNO) in Washington, D.C., and trips every quarter year to the International Time Bureau (BIH) in Paris, France. During one of the NBS clock trips, *one* person was carrying *two* rubidium clocks to the BIH; the two independent clocks yielded measurements differing by only 90 nanoseconds.

The measurement results of the USNO and BIH comparisons indicate that the time signals of NBS, USNO, and the internationally coordinated universal time (UTC) independently maintain an accuracy of about 100 nanoseconds over extended time periods (3 months), which corresponds to a fractional frequency stability of about 1×10^{-14} over such extended times. This is nearly one order of magnitude better than data which are based on Loran C measurements, indicating that a substantial portion of the time (and frequency) fluctuations previously attributed to the time-generating clocks in the various institutions is due to (still only partially understood) fluctuations in the Loran C signals.

NBS, NIH OFFER NEW MASS SPECTRA DATA BASE

A new data base for mass spectrographic analysis, designated mass spectral data base, is available under a one-year renewable lease from the Office of Standard Reference Data, National Bureau of Standards, A537 Administration Building, Washington, D.C. 20234.

The National Bureau of Standards in cooperation with the National Institutes of Health (NIH) is offering a new computerized data base for the electron im-

pact ionization mass spectra of 25 600 compounds. The data base can be used to quickly and cheaply identify those compounds in studies of environmental pollutants, food additives, and similar investigations requiring mass spectrographic analysis.

The data were compiled jointly by the National Heart, Lung, and Blood Institute of NIH, the Environmental Protection Agency, and the United Kingdom's Mass Spectrometry Data Centre.

Each spectrum is recorded in a magnetic tape format with the Chemical Abtracts Service name and registry number assigned to the compound, and a "quality index" evaluation of the spectrum. A structure code assigned to each compound makes possible sophisticated search techniques, such as finding all compounds in the data base with structures similar to an unknown compound.

Under the terms of a June 1 agreement, the NBS Office of Standard Reference Data will distribute the data base to interested users and assist NIH in developing better techniques for evaluating the quality of the spectra. The data base will be periodically updated as new spectra are submitted and evaluated.

STUDY OF GRAIN MOISTURE METERS BEGUN

A joint program to study the accuracy of electronic grain moisture meters, and possibly develop improved methods for measuring the moisture content of grains, rices, and pulses is being undertaken by NBS and the newly organized Federal Grain Inspection Service of the Department of Agriculture.

Doyle Ellerbruch, Electromagnetics Division, Room 4643, Boulder, Colo., 303/499-1000, ext. 3658.

National grade standards set by the Federal Grain Inspection Service (FGIS) require the measurement of the moisture content of all grains and rices, as well as pulses such as beans, peas, and lentils. The official standard for such measurements is an air-oven drying process, which takes about 24 hours to run. For convenience at grain elevators and ports, the measurement is made by electronic meters that measure the dielectric constant (ability to hold an electric charge) of a grain sample.

The dielectric constant depends on the type of grain or bean, its moisture content, growing conditions or regions, and factors such as temperature and humidity. Conversion charts relating air-oven data to dielectric constants for different crop categories are prepared yearly by FGIS for use by national, state, and local inspection officials.

Under a memorandum of understanding, effective June 1, 1977, FGIS will provide the National Bureau of Standards with grain samples and moisture information, and may fund research and development projects for grain moisture meters. NBS will continue to study the relationship between dielectric constant values for various crops and their officially determined moisture content to determine whether better measurement methods might be developed. NBS will also investigate the possibility of accurately measuring grain moisture with continuous on-line monitors (present methods only measure random samples from a grain lot).

NBS research in this area is about two years old. The Bureau has studied the variables—such as density and temperature—that affect the accuracy of the widely used capacitance cell meters, as well as new systems which measure the dielectric constant of a grain sample by its microwave transmission characteristics. The latter method might lead to a simple on-line technique for measuring moisture.

The Federal Grain Inspection Service was established by USDA on November 20, 1976. Its primary task is to implement the U.S. Grain Standards Act, including setting official U.S. grade standards, promoting their uniform application, providing unbiased inspection and measurement services, and, as a result of 1976 amendments to the Act, providing original inspection and weighing of all grain sold for export.

SILICON FOR INFRARED IMAGING CREATES NEW MEASUREMENT PROBLEMS

Silicon, the basic material in most semiconductor electronics applications, is new to the field of thermal imaging in the infrared. However, because the photoresponse of doped-silicon detectors depends on material properties that are generally of only secondary importance in other silicon devices, the technology for measuring these parameters had not been previously developed to respond to these new measurement needs. As a result, new significance has been given to measurement problems that have largely lain dormant.

Robert D. Larrabee, Electronic Technology Division, A327 Technology Building, 301/921-3625.

The value of being able to see in the infrared portion of the spectrum was dramatically shown by the effective tactical use of the Snooperscope in the Second World War. More recently, thermal imaging—the viewing of objects by the light

turn page

of their own thermal radiation—has become a very important technique for a variety of scientific, industrial, military, and medical applications. Traditionally, detectors for the longer wavelengths of primary interest in thermal imaging have been constructed of relatively unknown and exotic materials that just happen to possess the properties needed for this relatively demanding application.

Silicon, the basic material in semiconductor electronics, is a relatively new arrival to the field of thermal imaging in the infrared. The photo-response of silicon can be extended to the desired longer infrared wavelengths by appropriate doping and by operating at cryogenic temperatures where the dopant states are deionized. The disadvantages of cooling are more than offset by the advantages of being able to use silicon technology to fabricate large numbers of detectors in two-dimensional array formats together with the associated signal-conditioning and read-out circuitry in an integrated, monolithic form. By being able to make two-dimensional arrays with a large number of elements, one circumvents the limitations of the more conventional mechanically scanned linear array approach, and opens the door to a much wider variety of applications.

Although silicon, by virtue of its use in semiconductor electronics, may be one of the most studied elements in the history of mankind, and certainly is the element whose technology is the most advanced, its relatively recent use as a detector material for the longer infrared wavelengths has spawned a variety of new measurement problems. The photo-response of doped-silicon detectors depends on material properties (e.g. residual compensation level) that are generally of only secondary importance to most other silicon devices. As a result, the technology for measuring these parameters has not been previously developed to the point of being fully responsive to this new need.

The National Bureau of Standards has recently initiated a program to identify those material parameters that can best characterize the infrared detection capabilities of doped-silicon wafers. To be able to adequately characterize the starting material will obviate the present costly procedure of having to wait until the complex infrared detector circuit has been fabricated to find out whether the starting material is satisfactory.

To be most useful, the selected characterization parameters should be relatively easy to measure by some nondestructive technique that can be applied to every wafer before it is processed into detector arrays. Conventional wafer screening techniques may be helpful, but at best, will be incomplete because they are usually not concerned with those parameters of particular interest to infrared detection and are certainly not performed at the cryogenic temperatures where the desired parameters are dominant. In addition, uniformity over the wafer surface is usually of paramount importance for thermal imaging arrays, so a single measurement of the average value of the characterizing parameter is inadequate. What is needed is a mapping of the value of the characterizing parameter over the complete wafer surface—a pictorial representation not only of the average value of the parameter of interest, but also of its uniformity as well. To be able to achieve adequate material characterization is a very real problem, riddled with constraints, necessarily involved with new measurement technologies, and potentially of great value to the emerging infrared imaging array industry.

An initial short-term goal of this program concerns an extraneous acceptor level in indium-doped silicon detectors which has been reported by some observers, but not noticed by others. If present, this extraneous acceptor can degrade the performance of detectors, so it becomes important to determine whether such a level really exists or is an artifact of the measurement techniques used for characterization. If this is real and universally present in material from all available sources, its characterization may well determine one of the parameters of interest for the wafer screening discussed above.

NEW CALIBRATION SERVICES FOR RADIATION STERILIZING AND PROCESSING INDUSTRIES

A new form of dosimeter calibration for high doses of radiation has been added to the NBS services available to U.S. industry.

William L. McLaughlin, X-ray Physics Division, C216, Radiation Physics Building, 301/921-2201.

We have developed high-precision radiochromic dye film dosimeters that make it possible for NBS to offer a calibration service for large absorbed doses of radiation. This large-dose range has previously been neglected in standardizing the measurement of ionizing radiation. The new dosimeters are now commercially available and may be used by industry as convenient transfer instruments.

Typically, through the calibration service, a user may irradiate an NBS dosimeter by exposing it alongside his own control dosimeters, then return it to NBS for reading of the absorbed dose, which is provided by NBS to ± 2 percent. Alternatively, the user may send his own dosimeter (which may be of a different type) to NBS for irradiation to a standard dose level in a ^{60}Co gamma-ray source.

NBS can also provide a number of specialized adjunct services, such as round-robin intercomparison of dosimeters between laboratories, spectrophotometric readout characteristics for a given dosimeter, irradiation and storage of dosimeters at dry-ice temperatures, or in-plant studies of radiation dose distribution within a manufactured product.

The range of NBS' new calibration services is 10^3 to 10^6 grays (10^5 to 10^8 rads),

designed for dosage with x rays, gamma rays, and electron beams. Such levels of radiation have recently found successful applications in several U.S. industries, particularly in the sterilization of many disposable medical supplies and food and drug containers, and in the improvement of physical properties of certain polymers (wire and cable insulation, dry lubricants, elastomers, food wrappers, and shrinkable tubing), and in the curing of paints and special textiles. In industrial radiation sterilization, reliable and accurate dosimetry is especially important for quality control and assuring public health and safety. Too low a dose may not provide sterility of the product. Too high a dose, on the other hand, might result in mechanical failure of the product (such as breakage of a syringe or suture during use) or of its package.

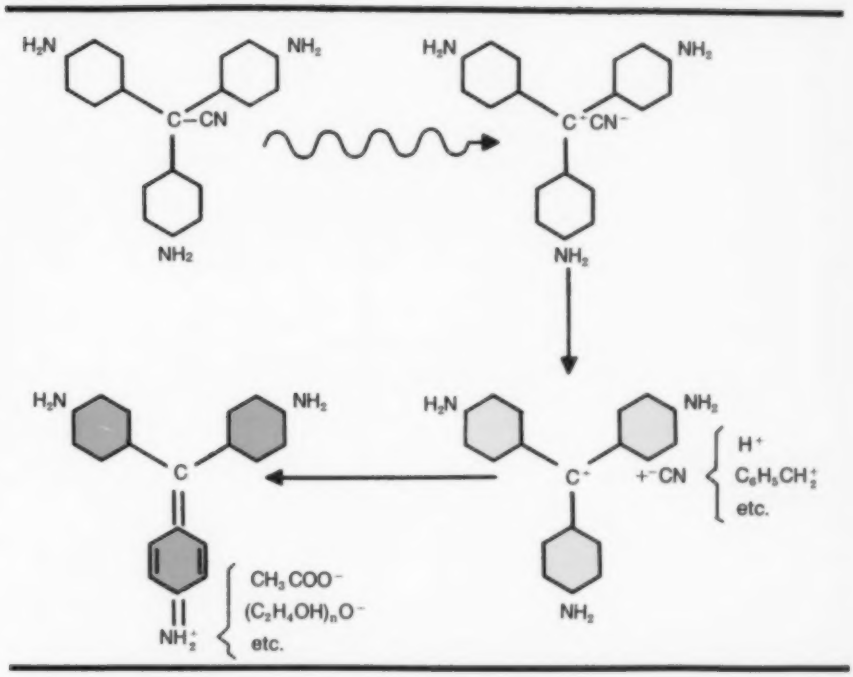
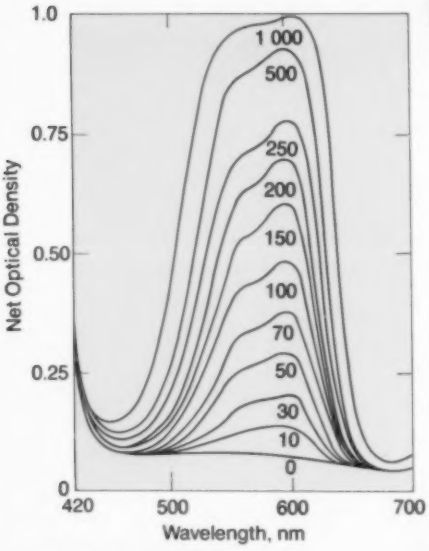


Figure 1—Radiation-Initiated Chemical Reaction of a Radiochromic Dye, the Leucocyanide of a Triphenylmethane Dye, For the Parent Dye, Pararosaniline. *This reaction is the basis for standardized radiation dosimetry using liquid or solid solutions of the dye cyanide.*



Absorbed Dose (Gy)
1 gray (Gy) = 100 rads

Figure 2—Changes in the Absorption Spectrum of Solutions of Hydroxyethyl Pararosaniline Cyanide Due to Irradiation with Cobalt-60 Gamma Rays (*the absorbed dose in grays is indicated for each spectrum*).

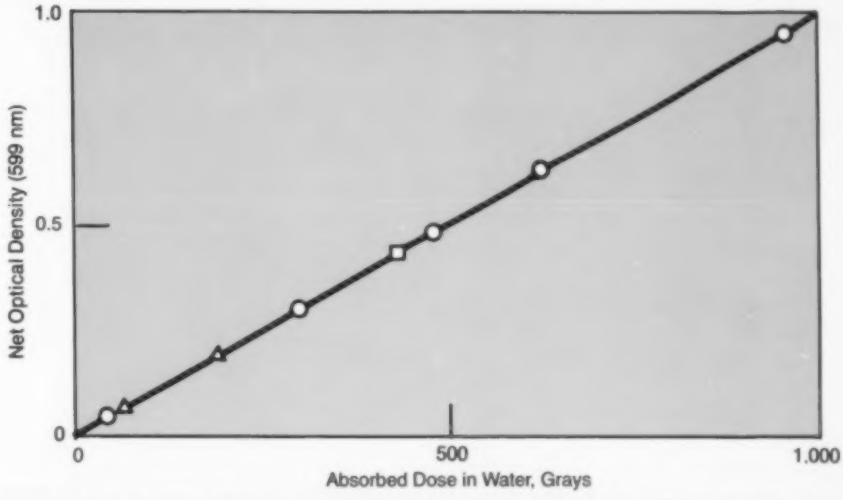


Figure 3—Calibration of the Response of this NBS Radiochromic Dye Dosimeter, in Terms of Change in Optical Transmission Density at 599-nm Wavelength, Versus the Radiation Absorbed Dose.

CONFERENCES

For general information on NBS conferences contact Sara Torrence, NBS office of Information Activities, Washington, D.C. 20234, 301/921-2721.

CARDIAC PACEMAKERS WORKSHOP

The National Bureau of Standards will sponsor a third Workshop on Reliability Technology for Electronic Cardiac Pacemakers at NBS headquarters, Gaithersburg, MD., October 19-20, 1977.

This is the third in a series of workshops intended to provide a forum for pacemaker manufacturers and other interested parties to address technical questions about the enhancement and assurance of pacemaker reliability. Some 150,000 Americans have pacemakers implanted in their chests to assist heart functioning.

Topics to be discussed at the workshop include tests and procedures used in the procurement and assurance of high reliability pacemakers batteries and leads; materials; and electronic components including discrete devices and integrated and hybrid circuits. Test methods of specific interest are those for measuring leaks and moisture in electronic component and pacemaker packages.

For further information contact: Harry A. Schafft, A327 Technology Building, 301/921-3625.

9TH MATERIALS RESEARCH SYMPOSIUM PAPERS SOLICITED

Papers are now being solicited for the 9th Materials Research Symposium to be held April 10-13, 1978, at the National Bureau of Standards in Gaithersburg. The title of the symposium is "Trace Organic Analysis: A New Frontier in Analytical Chemistry."

Researchers in diverse areas must currently perform critical analyses on minute quantities of organic compounds in various matrices. The objective of the symposium is to bring together these scientists to assess the state of the art and future direction of trace organic analysis and to explore common problems and new technology. The symposium will emphasize the total analysis, from collection of the sample through interpretation of results.

The following sessions have been scheduled for contributed papers:

—Analysis of aqueous ecosystems
—Analysis of air and the upper atmosphere
—Analysis of drugs in body fluids
—Analysis of neurotransmitters and hormones
—Analysis of nutrients
—Analysis of food toxicants
—Analytical systems for trace organic analysis
—General session on trace organic analysis
—Special session on new mass spectrometric techniques

In addition, plenary sessions have been scheduled on sampling methods, sample preparation, and analytical systems for trace organic analysis and on analytical techniques on the horizon.

Persons interested in presenting papers should submit abstracts of 250-300 words by September 15 to Dr. Stephen N. Chesler or Dr. Harry S. Hertz, A105 Chemistry Building, 301/921-2153.

CONFERENCE CALENDAR

September 21-23

SYMPOSIUM ON ROOFING TECHNOLOGY, NBS, Gaithersburg, MD; sponsored by NBS and the National Roofing Contractors Association; contact: Robert G. Mathey, B348 Building Research Building, 301/921-3407.

September 28-30

DATA ELEMENT MANAGEMENT SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and ANSI Committee X3L8; contact: Hazel McEwen, B226 Technology Building, 301/921-3157.

October 4-6

ALTERNATIVES FOR CADMIUM ELECTROPLATING IN METAL FINISHING, NBS, Gaithersburg, MD; sponsored by NBS, Consumer Product Safety Commission, Department of Defense, Department of Interior, Occupational Safety and Health Administration, Environmental Protection Agency, Food and Drug Administration, and General Services Administration; contact: Fielding, Ogburn, B166 Polymers Building, 301/921-2957.

October 11-13

MATERIALS FOR COAL CONVERSION AND UTILIZATION, NBS, Gaithersburg, MD; sponsored by NBS, Energy Research and Development Administration, Electric Power Research Institute; contact: S. J. Schneider, B303 Materials Building, 301/921-2893.

October 11-14

COMPUTER PERFORMANCE EVALUATION USERS GROUP, 13TH MEETING, New Orleans, LA., sponsored by NBS; contact: Dennis Conti, A248 Technology Building, 301/921-3861.

*October 12-14

WORKSHOP ON LOW TEMPERATURE MATERIALS FOR MAGNETIC FUSION DEVICES, Vail, Colo.; sponsored by NBS and Energy Research and Development

Administration; contact: Fred Ackett, NBS, 303/499-1000, ext. 3785.

October 17-19

TIME AND FREQUENCY CALIBRATION: METHODS AND RESOURCES, NBS, Boulder, Colo.; sponsored by NBS; contact: Roger Beehler, NBS, Boulder, Colo., 303/499-1000, ext. 3281.

October 19-20

RELIABILITY TECHNOLOGY FOR CARDIAC PACEMAKERS, NBS, Gaithersburg, MD; sponsored by NBS; contact: Harry A. Schafft, A327 Technology Building, 301/921-3625.

November 1-3

MECHANICAL FAILURES PREVENTION GROUP, NBS, Gaithersburg, MD; sponsored by NBS and MFPG; contact: Harry C. Burnett, B260 Materials Building, 301/921-2818.

November 13-17

WORKSHOP ON RAPID SOLIDIFICATION TECHNOLOGY, Sheraton-Reston, Reston, VA; sponsored by NBS and ARPA; contact: Dr. Arthur Ruff, B264 Materials Building, 301/921-2811.

December 5-7

WINTER SIMULATION CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS, the Association for Computing Machinery, the Institute of Electrical and Electronic Engineers, Operations Research Association of America, the Institute for Industrial Engineers, and the Society for Computer Simulation; contact: Paul F. Roth, B250 Technology Building, 301/921-2545.

*December 15

COMPUTER NETWORKING SYMPOSIUM, NBS, Gaithersburg, MD; sponsored by NBS and the IEEE Technical Communications on Computer Communications; contact: Helen Wood, B212 Technology Building, 301/921-2601.

1978

*March 13-15

CONSTRUCTION DOCUMENTATION CONFERENCE; NBS, Gaithersburg, MD; sponsored by NBS, the Construction Specifications Institute, and the Guide Specifications Committee of the Federal Construction Council; contact: Roger Rensburger, A151 Technology Building, 301/921-3126.

*March 22-24

28TH IEEE VEHICULAR TECHNOLOGY CONFERENCE; Denver, Colo.; sponsored by NBS and IEEE; contact: John Shafer, NBS, Boulder, Colo., 303/499-1000, ext. 3185.

April 10-13

TRACE ORGANIC ANALYSIS: A NEW FRONTIER IN ANALYTICAL CHEMISTRY, NBS, Gaithersburg, MD; sponsored by NBS; contact: Harry S. Hertz, A105 Chemistry Building, 301/921-2153.

April 17-20

ACOUSTIC EMISSION WORKING GROUP MEETING, NBS, Gaithersburg, MD; sponsored by NBS; contact: John A. Simmons, B118 Materials Building, 301/921-3355.

April 23-26

AMERICAN NUCLEAR SOCIETY TOPICAL CONFERENCE ON COMPUTERS IN ACTIVATION ANALYSIS AND GAMMA RAY SPECTROSCOPY: Mayaguez, Puerto Rico; sponsored by NBS, American Chemical Society, American Nuclear Society, Energy Research and Development Administration, U. of Puerto Rico, Puerto Rico Nuclear Center; contact: B.S. Carpenter, B108 Reactor Building, 301/921-2167.

May 8-10

SYMPOSIUM ON REAL-TIME RADIOGRAPHIC IMAGING, NBS, Gaithersburg, MD; sponsored by NBS and the American Society for Testing and Materials; contact: Donald A. Garrett, A106 Reactor Building, 301/921-3634.

*June 19-21

GAS KINETICS CONFERENCE, NBS, Gaithersburg, MD; sponsored by NBS and the Committee on Chemical Kinetics, NBS/NRC; contact: David Garvin, B152 Chemistry Building, 301/921-2771.

June 26-29

CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS, Ottawa, Ontario, Canada; sponsored by Institute of Electrical and Electronics Engineers, U.S. National Committee-International Union of Radio Science, and NBS; contact: Dee Belsher, NBS, Boulder, Colo., 303/499-1000, ext. 3981.

*July 17-20

AMERICAN ASSOCIATION FOR CRYSTAL GROWTH IV, NBS, Gaithersburg, MD; sponsored by NBS and AACG; contact: Dr. Robert Parker, B164 Materials Building, 301/921-2961.

* New Listings.

PUBLICATIONS

METRIC CONVERSION GUIDELINES FOR THE BUILDING COMMUNITY

Recommended Practice for the Use of Metric (SI) Units in Building Design and Construction, Milton, H. J., Nat. Bur. Stand. (U.S.), Tech. Note 938, 47 pages (Apr. 1977), Stock No. 003-003-01761-2, $1.60.

A new publication from the National Bureau of Standards—*Recommended Practice for the Use of Metric (SI) Units in Building Design and Construction*—provides the technical basis for a single, comprehensive, and authoritative standard for SI to be used in building design, product manufacture, and construction applications.

The publication describes the nature of SI and gives rules and recommendations for the presentation of SI units and symbols and numerical values associated with SI. Comprehensive tables are included that show working SI units and typical applications in areas such as electricity and magnetism, thermal effects and heat transfer, lighting and acoustics.

Appendixes show conversion factors for the most common units, metric units not recommended for use with SI, a chart depicting SI units and relationships, and appropriate references.

The publication also discusses special consideration in the use of SI units in building design and construction such as linear measurements, area, volume, and fluid capacity, geometrical cross sectional properties, mass, weight, force, pressure, stress, temperature and others necessary to building calculations. It recommends using only millimeters and meters, not centimeters, on drawings to save space and time.

Prepared in response to requests from the American Society for Testing and Materials and the American National Metric Council to provide the basis for a national standard, the report was authored by Hans Milton, technical consultant on metrication and coordination of dimensions in building for NBS' Center for Building Technology.

From 1970 to 1974, Milton was a key figure in the Australian change to metric measurement in building design and construction. He is now Assistant Secretary for Housing Research in the Australian government and, on loan, assists NBS in research and planning for metrication in the U.S. building industry.

In the publication Milton points out that in the building design and construction community the application of SI units together with the preferred numerical values, is certain to simplify and speed up calculations and facilitate all measurement activities. Because SI is a coherent system of units with only one unit for any physical quantity, there is no need to convert within the system—from one unit to another as with inches and feet or ounces and pounds.

TEACHER AIDS

The following publications produced by agencies of the federal government have been examined and recommended by DIMENSIONS/NBS for their potential value as supplements to the high school classroom or library.

Women and Minorities in Science and Engineering (NSF 77-304)

A 24-page graphic and analytical report by the National Science Foundation's Division of Science Resources Studies. Helps to answer students' questions concerning: How numerous are women and minorities in the contemporary science and engineering work force? Are their talents well utilized? Is the pay good? Among aspects treated are: "Transition from School to Work," "Trends," and "Future Prospects." Inside cover list other NSF publications on characteristics of the U.S. science and engineering population and Science Resources Publications on other subjects. Order NSF 77-304 (Stock No. 038-000-00307-1) at 75¢ a copy from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Otto Lilienthal and Octave Chanute: Pioneers of Gliding

A late 19th century photograph, showing Lilienthal "gliding with biplane" from a Berlin suburban hillside, provides a dramatic cover for this informative 8-page booklet. Early efforts that "laid the foundation for the design of the first successful flying machines" are effectively described and a price list with ordering information for the charming vintage photos is included. On the concluding page is a useful reading list. Obtain free from the National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560.

Smoke Detectors—What They Are and How They Work (LC 1074)

An illustrated National Bureau of Standards leaflet describing both photoelectric and ionization chamber smoke detectors, with attention to commonly asked questions concerning the "reliable early warning system" that smoke detectors provide. The information presented is based on findings of the NBS Center for Fire Research. Single copy free: Write to: Consumer Information Center, Pueblo, Colorado 81009.

OF THE NATIONAL BUREAU OF STANDARDS

Building Technology

Clark, R. E., and Roat, C. L., *Metrication and Dimensional Coordination—A Selected Bibliography*, Nat. Bur. Stand. (U.S.), Spec. Publ. 458, 32 pages (Apr. 1977) Stock No. 003-003-01684-5, 75 cents.

Fattal, S. G., Sherwod, G. E., and Wilkinson, T. L., *Building to Resist the Effect of Wind. Volume 3: A Guide for Improved Masonry and Timber Connections in Buildings*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 100-3, 56 pages (May 1977) Stock No. 003-003-01719-1, $200.

Kliment, S. A., *Building to Resist the Effect of Wind. Volume 5: Housing in Extreme Winds: Socio-Economic and Architectural Considerations*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 100-5, 37 pages (May 1977) Stock No. 003-003-01721-3, $1.50.

Kowalski, J. G., *Building to Resist the Effect of Wind. Volume 4: Forecasting the Economics of Housing Needs: A Methodological Guide*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 100-4, 36 pages (May 1977) Stock No. 003-003-01720-5, $1.50.

Lew, H. S., Ed., *Wind and Seismic Effects. Proceedings of the Seventh Joint Panel Conference of the U.S.-Japan Cooperative Program in Natural Resources, May 20-23, 1975, Tokyo, Japan*, Nat. Bur. Stand. (U.S.), Spec. Publ. 470, 513 pages (Apr. 1977) Stock No. 003-003-01762-1, $5.60.

Marshall, R. D., Raufaste, N. J., Jr., Kliment, S. A., *Building to Resist the Effect of Wind. Volume 1: Overview*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 100-1, 34 pages (May 1977) Stock No. 003-003-0717-5, $1.40.

Simiu, E., and Marshall, R. D., *Building to Resist the Effect of Wind. Volume 2: Estimation of Extreme Wind Speeds and Guide to the Determination of Wind Forces*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 100-2, 29 pages (May 1977) Stock No. 003-003-01718-3, $1.30.

Sleater, G. A., *Stone Preservatives: Methods of Laboratory Testing and Preliminary Performance Criteria*, Nat. Bur. Stand. (U.S.), Tech. Note 941, 79 pages (May 1977) Stock No. 003-003-01727-2, $2.30.

Computer Science and Technology

Evans, J. M., Jr., Kirsch, R., and Nagel, R. N., Eds., *Computer Science and Technology: Workshop on Standards for Image Pattern Recognition. Proceedings of a Workshop held at the National Bureau of Standards, Gaithersburg, MD, June 3-4, 1976*, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-9, 115 pages (May 1977) Stock No. 003-003-01771-3, $2.50.

Wood, H. M., *Computer Science and Technology: The Use of Passwords for Controlled Access to Computer Resources*, Nat. Bur. Stand. (U.S.), Spec. Publ. 500-9, 59 pages (May 1977) Stock No. 003-003-01770-1, $2.

Energy Conservation and Production

Liu, S. T., Hunt, C. M., and Powell, F. J., *Evaluation of Ventilation Requirements and Energy Consumption in Existing New York City School Buildings*, Nat. Bur. Stand. (U.S.), Bldg. Sci. Ser. 97, 69 pages (Apr. 1977) Stock No. C03-003-01768-0, $2.10

Engineering, Product and Information Standards

Meissner, P., *Guidelines on Evaluation of Techniques for Automated Personal Identification*, Nat. Bur. Stand. (U.S.), Fed. Info. Process. Stand. Publ. (FIPS PUB 48), 22 pages (Apr. 1977)

Fluids: Liquids, Gases and Plasmas

Hanley, H. J. M., *Predicted Values of the Viscosity and Thermal Conductivity Coefficients of Nitrous Oxide*, Nat. Bur. Stand. (U.S.), Tech. Note 693, 64 pages (Mar. 1977) Stock No. 003-003-01780-8, $1.20.

Metrology: Physical Measurements

Saunders, R. D., and Shumaker, J. B., *Optical Radiation Measurements: The 1973 NBS Scale of Spectral Irradiance*, Nat. Bur. Stand. (U.S.), Tech. Note 594-13, 36 pages (Apr. 1977) Stock No. 003-003-01709-4, $1.40.

Thermodynamics and Chemical Kinetics

Nuttall, R. L., and Armstrong, G. T., *Estimation of Net Enthalpies of Combustion of Some Aviation Fuels Expressed in the International System of Units (SI)*, Nat. Bur. Stand. (U.S.), Tech. Note 937, 63 pages (Apr. 1977) Stock No. 003-003-01763-9, $1.30.

Other Subjects of General Interest

Shorten, F. J., Ed., *NBS Reactor: Summary of Activities July 1975 to June 1976*, Nat. Bur. Stand. (U.S.), Tech. Note 939, 140 pages (May 1977) Stock No. 003-003-01769-8, $2.75.

Publications listed here may be purchased at the listed price from the Superintendent of Documents, US. Government Printing Office, Washington, D.C. 20402 (foreign: add 25%). Microfiche copies are available from the National Technical Information Service, Springfield, Va. 22161. For more complete periodic listings of all scientific papers and articles produced by NBS staff write: Editor, Publications Newsletter, Administration Building, National Bureau of Standards, Washington, D.C. 20234.

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NEWS BRIEFS

BOTTLES TO BE SAFER. A new Voluntary Product Standard for the strength and durability of carbonated soft drink bottles was approved for publication by NBS and went into effect on September 15. The standard, requested by the Glass Packaging Institute and the National Soft Drink Association, is designed to improve the safety of conventional glass bottles used as containers for carbonated soft drinks. It covers returnable and non-returnable bottles made from soda-lime-silica glass, but it does not apply to plastic-covered bottles.

PROGRESS REPORTS ON RECYCLED OIL. NBS will host its second conference on "Measurements and Standards for Recycled Oil" November 29 and 30 at the Gaithersburg, Md., laboratories. The main topic will be progress on test procedures for establishing the quality of used oil that will be recycled and furnished as fuel oil. The conference will also concern plans for engine oils, the next end-use of recycled oils to be considered in the NBS recycled oil program. For more information contact: Donald A. Becker, NBS, Washington, D.C. 20234, 301/921-3837.

CRITERIA FOR EARTHQUAKE-PROOF BUILDINGS. New criteria for designing earthquake-resistant buildings are now being developed through the NBS Center for Building Technology under the sponsorship of the National Science Foundation. They should be ready later this year. NBS and NSF also have begun a project to plan how the new seismic design criteria can be adopted rapidly by design professionals to reflect the current state-of-the-art in earthquake engineering. When adopted, they should significantly reduce death and damages from earthquake.

TWO PRECISION MEASUREMENT GRANTS AWARDED. NBS has awarded two Precision Measurement Grants for the year beginning September 15, 1977. The awards of $24,500 each will go to Professor Robert S. Van Dyck, Jr., of the University of Washington in Seattle and jointly to Professors William M. Fairbank, Jr., and George J. Collins of Colorado State University. Van Dyck's project involves cryogenics and ion isolation techniques in work related to the determination of fundamental constants. Fairbank and Collins will apply laser spectroscopy to the study of energy levels of helium atoms, with implications for quantum electrodynamic theory.

MATERIALS FOR MEASURING FUEL ECONOMY. New Standard Reference Materials from NBS will promote more accurate measurement of fuel consumption of internal combustion engines. The SRM's, Carbon Dioxide in Nitrogen (SRM 2619-2626), are intended for calibration of instruments that make high accuracy measurements of carbon dioxide, the major constituent of automobile exhaust. They are designed for use by the Environmental Protection Agency and by automobile manufacturers who determine fuel consumption by measuring exhaust products. Write: NBS Office of Standard Reference Materials, B311 Chemistry Bldg., Washington, D.C. 20234.

NEXT MONTH IN

DIMENSIONS/NBS

Where does a state or local government turn when faced with a technical problem? Officials in Oregon contacted the National Bureau of Standards after the collapse of this bridge near Coos Bay. Read about federal technology as a local resource in the next issue of DIMENSIONS/NBS.

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The National Bureau of Standards was established by Congress in 1901 to advance the Nation's science and technology and to promote their effective application for public benefit. Manufacturing, commerce, science, government, and education are principal beneficiaries of NBS work in the fields of scientific research, test method development, and standards writing. DIMENSIONS/NBS describes in technical and general terms results of NBS activity in areas of national concern such as energy conservation, fire safety, computer applications, environmental protection, materials utilization, and consumer product safety and performance. The functions of NBS are divided into four major institutes: Institute for Basic Standards, Institute for Materials Research, Institute for Applied Technology, and Institute for Computer Sciences and Technology.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription: Domestic, $12.50, foreign, $15.65, single copy, $1.05. The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1981.